American Journal of Water Resources, 2018, Vol. 6, No. 5, 186-188
Available online at http://pubs.sciepub.com/ajwr/6/5/1

DOI:10.12691/ajwr-6-5-1

New Fundamental Concept Useful for Classification of Water Quality

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Received September 13, 2018; Revised October 19, 2018; Accepted November 09, 2018

Abstract Due to human and human activities, the groundwater polluted. This is the severe century problem now. Thus the analysis of the water quality is critical to preserve and perfect the natural ecosystem. The primary objective of this paper is to study the groundwater quality parameters. Elhag Banaga's diagram can understand the mechanism of chemical reactions leading to the change in the composition of groundwater and source of the dissolved ions in the groundwater. The diagram innovates not only shown the nature of given water sample graphically and dictates the relationship to other samples, but there are some different methods and schemes used to classify natural water quality, source, origin and determine their suitability for different purposes depending on the concentrations of the necessary components. The new diagram is useful for better understanding the evolution of hydrochemical parameters of groundwater that can be by plotting the concentration of major cations and anions in percentage, and itis divides the water quality into four types. The results of this analysis compared with the water quality standards of Elhag Banaga's diagrams, 2018. (Trigonal shapes) and Piper diagram.

Keywords: *hydrochemical facies, new diagram, water quality*

Cite This Article: Elhag A. B, Siddig M.E., and Musa M. A., "New Fundamental Concept Useful for Classification of Water Quality." *American Journal of Water Resources*, vol. 6, no. 5 (2018): 186-188. doi: 10.12691/ajwr-6-5-1.

1. Introduction

The movement of percolating water through larger pores is much more rapid than through the finer pores. The overall effect of all these factors is that the composition of groundwater varies from time to time and from place to place. Groundwater often consists of seven major chemical elements Ca^{++}, Mg^{++}, Na^{+}, K+, HCO_3^{-}, SO_4^{-2} and Cl^{-}, all groundwater contains salts in a solution that derived from the location and past movement of the water through the different rock formations. It can also act as a strong weathering agent apart from the general solution effect. Consequently, the chemical composition of groundwater will vary depending upon several factors like frequency of precipitation, which will leach out the salts, time of stay of rainwater in the root-zone and intermediate zone, the presence of organic matter etc. In this paper was innovate and create new graphs (crystal forms), which are more useful for bringing out the chemical relationships amongst groundwater samples and display a brief description of the water quality data. The graphs can aid in comparing analysis and for emphasising similarities and differences between the other standard possible plotting methods as Elhag Banaga diagrams and Piper (Figure 1 and Figure 2) respectively.

To understand the quality of groundwater is as essential as itis quantity because it is the primary factor determining the suitability for domestic, drinking, agricultural and industrial purposes. Etu-Efeotor, [1] announced that the groundwater is never really chemically pure as water invariably dissolves some of the minerals it comes in contact with, at any given time. Hydro-chemical processes such as dissolution, precipitation, ion exchange processes and the residence time along the flow path control the chemical composition of groundwater, and hydro-chemical characterization of water body presents the condition of water concerning its quality measuring parameters considered under the study. On the other hand, the dissolved constituents in groundwater are primarily controlled by the original chemical characters and temperature of the water entering the zone of saturation; the distribution, solubility and exchange capacity of minerals in the rock; the porosity and permeability of the aquifer and the flow pathways of the water [2,3,4,5].

The mineral substances dissolved in water divided into macro-component (Na^{+}, K^{+}, Ca^{++}, Mg^{++} and SO_4^{--}, Cl^{-}, HCO_3^{-}, CO_3^{--}) and micro-component (ions of lithium, rubidium, cesium and anions – bromine, iodine, fluorine, boron and ions of heavy metals) [6] specific combination of anions and cations in water distinguishes the hydro-chemical water types [7].

2. Methodology

Different graphical and statistical techniques have been developed to describe the concentrations or relative abundances of significant constituents and the pattern of variability in the different water samples. The diagram made of a combination of four different fields that have been recently used to classify the water into different water types based upon the cations and anions concentrations in the form of significantions percentage in a triangle and rectangular fields. Percentages calculatedregarding equivalent in millions of primary ions.

The new diagram is the planning division of arithmetic to distinguish the various groundwater groups regarding the main chemical components, and the most essential characteristic of this scheme is the speed and ease of dropping points itis composed of positive and negative ions together. The Banaga plotting systems not only graphically represents the nature of a given water sample, but were used in the study of water chemistry and quality developed by Elhag Banaga and Piper methods. This diagram is constructing relatively abundance of chief cations and anions with the percent meq/l.

2.1. Objectives

The objective of the present work is to discuss the major ion chemistry of groundwater. In this case, the methods proposed by Elhag Banaga, useful for classification have been used to study the hydrochemical characteristics of groundwater critically. In the evaluation of groundwater types, the goal is water quality investigation and planning for sustainable application of different sources of groundwater. The primary objectives of this study are:-

- Classification of water quality.
- Comparison between the qualities of water in the entire scheme and other diagram like Piper.

3. Results and Discussion

Snow crystal growth by vapour deposition generally occurs along one of two planes: the basal plane along one of three a-axes or the perpendicular plane or c- axis (Figure 1). The chemical parameters of groundwater play a significant role in classifying and assessing water quality. In this paper,some techniques and methods have been developed to interpret the chemical data. The diagram has summarized the various modes of data representation (trigonal shapes) and has discussed their possible uses; the description given; using a Table 1 and a number of Figure 1, of the different water types, after dropping a column from the middle of each rib pass the point 50%.

The new diagram divided waters into four basic types, which the water that plots within the zone (1) shows that the Ca^{++} + Mg^{++} and HCO_3^- and the region of water increase more than 50% and this kind of water have a temporary hardness, and hydro-geologically formation described as shallow and fresh water (recharge area, but the water that plots at zone (2) classified as Ca^{++} + Mg^{++} and Cl^- + SO_4^{--}, which the results in an area permanent hardness water. On the other hand, water described in the zone (3) as primarily composed of alkali carbonates (Na^+ + K^+ and HCO_3^- + CO_3^{--}) Table 1, while zone (4), describes the water is composed of (Na^+ + K^+ and SO_4^{--} + Cl^-) may be considered the older brackish and saltwater saline and ancient marine (discharge area), and it's dangerous for irrigation operations because they contain a high concentration of sodium ion.

Table 1. It Divides the Quality of Water into Four Different Types

Type of water	Zone No.
Alkaline sulphate chloride (Permanent hardness)	1
Alkaline bicarbonate (Temporary hardness)	2
Alkali bicarbonate (Alkali carbonare)	3
Alkali sulphate chloride (Saline)	4

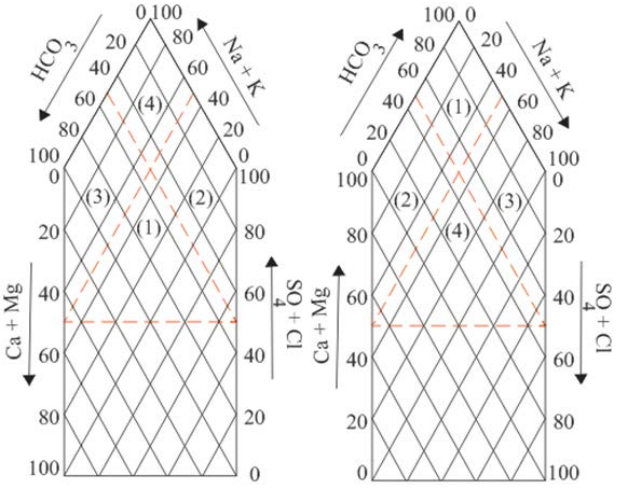

Figure 1. The trigonal diagram of Elhag Banaga

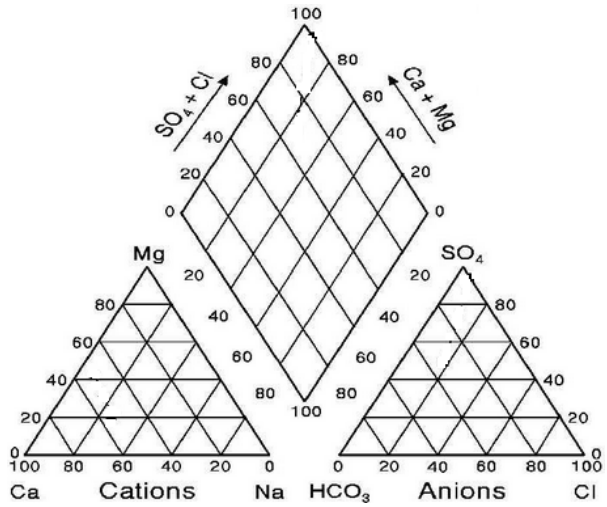

Figure 2. Piper diagram

4. Conclusion

The new diagram made of a combination of different fields that have been recently used to classify the water into different water types based upon the cations and anions concentrations in the form of significant ions percentage, which including four types of the water Table 1. The interpretation of hydro-chemical analysis reveals the major ions data were plotted on Banaga's diagram indicated that four hydro-geochemical type facies.

Acknowledgements

The author would like to thank King Khalid University, Department of Civil Engineering for supporting this work.

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